California Regional Water Quality Control Board
San Diego Region

Total Maximum Daily Load (TMDL) for Metals
Chollas Creek Watershed

Draft Problem Statement
May 10, 2000

Problem Statement

Since 1994, storm water samples from Chollas Creek have frequently exceeded both chronic and acute water quality criteria established in the National Toxics Rule (NTR) (40 CFR Part 131.36 (d)(10)(ii)) for copper, lead, zinc, and cadmium. In April 2000, the United States Environmental Protection Agency (USEPA) promulgated 40 CFR 131.38, known as the California Toxics Rule (CTR), that established new water quality criteria for waters in California, including water quality criteria for copper, lead, zinc, and cadmium. In addition to exceeding NTR criteria, storm water samples from Chollas Creek collected between 1994 and 1999 have also periodically exceeded CTR water quality criteria for these metals. California must currently meet CTR, not NTR, water quality criteria.

In addition to exceeding CTR water quality criteria, samples of Chollas Creek storm water have not met the *Water Quality Control Plan for the San Diego Basin (9)* (Basin Plan) toxicity objectives for almost all tests performed since 1994 (URS Greiner Woodward Clyde 1994-1999). In response to the toxicity testing results, the Southern California Coastal Water Research Project (SCCWRP) and Ogden Environmental and Energy Services, Co. (Ogden) performed a Toxicity Identification Evaluation (TIE) for three storm events to identify the cause of the observed toxicity. TIE results indicated that in all three storms sampled, toxicity occurred to the purple sea urchin, *Strongylocentrotus purpuratus*. The TIE determined that the cause of the toxicity (i.e. reduced fertility) to the purple sea urchin was primarily due to zinc, and to a lesser extent also due to copper (SCCWRP 1999).

The Chollas Creek Watershed

Chollas Creek is an urban creek with highly variable flows. The highest flow rates are associated with storm events. During dry weather, there are often extended periods of no surface flows in the creek, although pools of standing water may be present. Much of the creek has been channelized and concrete lined, but some sections of earthen creek bed remain. The mouth of the creek is located on the eastern shoreline of the central portion of San Diego Bay.

The watershed of Chollas Creek encompasses 16,273 acres. The area of the north fork of the watershed (9,276 acres) is larger than that of the south fork (6,997 acres) (URS Greiner

Woodward Clyde 1999). As Table 1 indicates, the watershed is highly urbanized. Land use is predominantly residential, with some commercial and industrial use. A significant portion of the watershed consists of roadways, while the remaining land in the watershed is open space. Portions of the cities of San Diego, Lemon Grove, and La Mesa are located within the watershed. A small portion of the watershed consists of “tidelands” immediately adjacent to San Diego Bay. Some of this tideland area is under the jurisdiction of the San Diego Unified Port District; the remainder is under the jurisdiction of the United States Navy.

Table 1. Land Use in the Chollas Creek Watershed (URS Greiner Woodward Clyde 1999)

Land Use	Percent of Total Area (Entire Watershed)
Residential	67%
Commercial	5%
Industrial	7%
Roadways	4%
Open Space	16%

The annual average rainfall in the Chollas Creek watershed is approximately 9 inches (URS Greiner Woodward Clyde 1999). Rainfall statistics for the San Diego International Airport (a.k.a. Lindbergh Field, located approximately 4 miles northwest of Chollas Creek, near San Diego Bay) indicate that an average of 18 storms occur each year (URS Greiner Woodward Clyde 1999).

Beneficial Uses and Water Quality Objectives

The Basin Plan establishes beneficial uses and water quality objectives for Chollas Creek and San Diego Bay (SDRWQCB 1994). The beneficial uses for Chollas Creek are:

- Water contact recreation
- Non-contact water recreation
- Warm water habitat
- Wildlife habitat

Chollas Creek drains into San Diego Bay. The beneficial uses for San Diego Bay are:

- Industrial service supply
- Navigation
- Water contact recreation
- Non-contact water recreation

- Commercial and sport fishing
- Preservation of biological habitats of special significance
- Estuarine habitat
- Wildlife habitat
- Marine habitat
- Migration of aquatic organisms
- Shellfish harvesting
- Rare, threatened, or endangered species

Prior to the promulgation of the CTR, water quality criteria found in the NTR (40 CFR Part 131.36 (d)(10)(ii)) were used as reference values to evaluate Chollas Creek water quality. In the NTR, both 1-hour acute and 4-day chronic water quality criteria are calculated as a function of hardness, and the criteria are then compared against measured Event Mean Concentrations (EMCs). The EMC is defined as the total pollutant load divided by the total runoff volume. If the measured EMC was equal to or greater than acute or chronic criteria, the result was considered to exceed water quality criteria. For each EMC that exceeded criteria, an exceedance factor was calculated; for example, if an EMC was two times greater than criteria, the exceedance factor was 2.0. Copper, lead, zinc, and cadmium have exceeded both acute and chronic water quality criteria in a significant number of samples collected between 1994 and 1999 (URS Greiner Woodward Clyde 1994-1999). Table 2 shows the number of exceedances per number of storm water samples collected (e.g. “2/3” indicates that two out of three samples exceeded the EMC).

Table 2. Number of Exceedances per Number of Samples, and Range of Exceedance Factors for each Contaminant (URS Greiner Woodward Clyde 1994-1999)

Sample Dates	Copper range of exceedance factors *	Copper acute exceedances	Copper chronic exceedances	Cadmium range of exceedance factors *	Cadmium acute exceedances	Cadmium chronic exceedances	Zinc range of exceedance factors *	Zinc acute exceedances	Zinc chronic exceedances	Lead range of exceedance factors *	Lead acute exceedances	Lead chronic exceedances
93/94 T	1.61-3.38	3/3	3/3	1.15-1.89	2/3	0/3	1.90-3.04	3/3	3/3	1.07-66.6	2/3	3/3
94/95 T	1.38-4.05	4/4	4/4	1.08-1.92	0/4	3/4	1.09-4.52	4/4	4/4	1.07-35	2/3	3/3
94/95 D	N/A	0/4	0/4	N/A	0/4	0/4	N/A	0/4	0/4	2.0	0/4	1/4
95/96 T	2.84-4.22	1/1	1/1	N/A	0/1	0/1	1.7-1.89	1/1	1/1	>8.12	0/1	1/1
95/96 D	1.05-4.16	2/3	3/3	N/A	0/3	0/3	1.74-1.92	1/3	1/3	3.66-30.75	0/3	3/3
96/97 D	1.0-2.7	2/2	2/2	1.7	0/2	1/2	1.1-1.2	1/2	1/2	4.7-11.0	0/2	2/2
97/98 T	1.6-5.3	2/3	3/3	1.1-2.9	2/3	1/3	1.3-2.3	2/3	2/3	1.2-43.8	2/3	3/3

Sample Dates	Copper range of exceedance factors *	Copper acute exceedances	Copper chronic exceedances	Cadmium range of exceedance factors *	Cadmium acute exceedances	Cadmium chronic exceedances	Zinc range of exceedance factors *	Zinc acute exceedances	Zinc chronic exceedances	Lead range of exceedance factors *	Lead acute exceedances	Lead chronic exceedances
98/99 T	1.0-1.9	1/3	2/3	2.2	0/3	1/3	2.1-2.3	1/3	1/3	1.2-31.7	1/3	2/3

T= tested for total metals
D = tested for dissolved metals
N/A = not applicable
* Indicates the range of exceedance factors observed for both acute and chronic criteria exceedances

In addition to comparing storm water results to the NTR, sampling results have also been compared with the new CTR criteria. Calculations for CTR criteria are also a function of hardness, and are explained in detail in the Numeric Targets section of the TMDL. Table 3 shows the number of exceedences per number of samples using CTR criteria.

Table 3. Number of Exceedances per Number of Samples using CTR Criteria

Sample Dates	Copper acute exceedances	Copper chronic exceedances	Cadmium acute exceedances	Cadmium chronic exceedances	Zinc acute exceedances	Zinc chronic exceedances	Lead acute exceedances	Lead chronic exceedances
93/94 T	3/3	3/3	0/3	0/3	3/3	3/3	2/3	3/3
94/95 T	4/4	4/4	0/4	0/4	4/4	4/4	2/3	3/3
94/95 D	0/4	0/4	0/4	0/4	0/4	0/4	0/4	0/4
95/96 T	1/1	1/1	0/1	0/1	1/1	1/1	0/1	1/1
95/96 D	3/3	3/3	0/3	0/3	1/3	1/3	0/3	3/3
96/97 D	2/2	2/2	0/2	0/2	1/2	1/2	0/2	2/2
97/98 T	3/3	3/3	0/3	1/3	2/3	2/3	2/3	2/3
98/99 T	1/3	1/3	0/3	0/3	1/3	1/3	1/3	2/3

T= tested for total metals
D = tested for dissolved metals

After comparing sampling results with CTR criteria, it is noted that cadmium has not exceeded any dissolved chronic or acute criteria from 1994 through 1999. Cadmium has exceeded total chronic criteria only once; during the 1997/98 season one sample measured 3.0 µg/L and the criteria was 2.8 µg/L. Since cadmium does not appear to be exceeding dissolved CTR criteria, and was not found to be a cause of toxicity in test organisms, cadmium is not considered further for this TMDL.

Sampling History in the Watershed

Storm water monitoring of Chollas Creek began in the 1993-94 rainy season under the San Diego Municipal National Pollutant Discharge Elimination System (NPDES) storm water permit. Each rainy season, storm water samples are collected from two or three storms at a station located on the north fork of Chollas Creek near the intersection of 33rd and Durant Streets. To avoid tidal influence, the monitoring station is installed on the north fork above the north and south fork confluence. Runoff from approximately 57% of the entire watershed is sampled at the monitoring site (URS Greiner Woodward Clyde 1999). This is considered to be representative of the entire watershed because the land use distribution in the north fork portion of the watershed is nearly identical to the land use distribution of the entire watershed as shown in Table 4 below.

Table 4. Land Use Distribution for Chollas Creek Watershed (URS Greiner Woodward Clyde 1999)

Land Use	Percent of Total Acreage (Entire Watershed)	Percent of Sampled Acreage (North Fork Watershed)
Residential	67%	62%
Commercial	5%	9%
Industrial	7%	10%
Open Space	16%	14%
Roadways	4%	5%

Since the 1993-94 rainy season, storm water samples have been analyzed for general physical constituents, nutrients, biochemical oxygen demand, chemical oxygen demand, bacteriological constituents, organic constituents, and total recoverable metals. Some samples are also analyzed for dissolved metals. Toxicity testing began with the 1994-95 rainy season and is conducted using the water flea (*Ceriodaphnia dubia*) and the fish commonly known as a fathead minnow (*Pimephales promelas*). Toxicity as indicated by mortality was found in every test run on the water flea *Ceriodaphnia* for the municipal storm water program. Reproduction of the water flea *Ceriodaphnia* was generally not impaired, even in individuals that died later in the test. Toxicity was generally not found in tests run on the fathead minnow, but frequently some inhibition of growth was found.

Toxicity Identification Evaluation (TIE)

A toxicity identification evaluation (TIE) was conducted to determine the cause of the toxicity in storm water runoff in Chollas Creek. SCCWRP and Ogden conducted the TIE under an agreement by the Regional Board, the City of San Diego, the Port District, and the California Department of Transportation (CalTrans). The TIE effort was initiated in March 1999 and a final report was completed in November 1999. The TIE evaluated storm water from three storms in Chollas Creek. The first task of the TIE was to compare toxic responses of three commonly used test organisms; one freshwater (the water flea *Ceriodaphnia dubia)* and two marine species (the purple sea urchin *Strongylocentrotus purpuratus* and the mysid shrimp *Mysidopsis bahia*). The salinity of the storm water samples used for the marine organisms was adjusted to approximate seawater salinity levels. A Phase I TIE was conducted to ascertain the class or group of constituents responsible for the observed toxicity. A Phase II TIE was conducted in an effort to determine the primary constituent(s) responsible for the observed toxicity. A Phase III TIE was conducted to confirm the primary constituent(s). Results of the testing indicated that toxicity to the water flea and the purple sea urchin occurred in two and three of the storms, respectively. No toxicity was observed for the mysid shrimp in any of the storms sampled. The TIE results showed that toxicity to the water flea was caused by the pesticide diazinon and not metals; a separate TMDL for diazinon in Chollas Creek began in 1998. Toxicity to the purple sea urchin, however, was found to be primarily caused by zinc and, to a lesser extent, copper concentrations in the storm water runoff (SCCWRP 1999).

Applicable Water Quality Standards

Water quality standards consist of beneficial uses and water quality objectives. The Basin Plan specifies water quality standards for all waters in the San Diego region, including Chollas Creek and San Diego Bay. The water quality standards that are applicable to this TMDL are the narrative water quality objectives for toxicity in Chollas Creek and the beneficial uses of Chollas Creek that could be adversely affected by toxicity. There are no numerical water quality objectives in the Basin Plan for metals in Chollas Creek.

The following Basin Plan narrative water quality objective for toxicity is applicable to all inland surface waters (including Chollas Creek), enclosed bays (including San Diego Bay) and estuaries, coastal lagoons, and ground waters of the San Diego region.

> "All waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in human, plant, animal, or aquatic life. Compliance with this objective will be determined by use of indicator organisms, analyses of species diversity, population density, growth anomalies, bioassays of appropriate duration, or other appropriate methods as specified by the Regional Board.

> "The survival of aquatic life in surface waters subjected to a waste discharge or other controllable water quality factors, shall not be less than that for the same water body in areas unaffected by the waste discharge or, when necessary, for other control water that is consistent with requirements specified in US EPA, State Water Resources Control Board or other protocol authorized by the Regional Board. As a minimum, compliance with this objective as stated in the previous sentence shall be evaluated with a 96-hour acute bioassay.
>
> "In addition, effluent limits based upon acute bioassays of effluents will be prescribed where appropriate, additional numerical receiving water objectives for specific toxicants will be established as sufficient data become available, and source control of toxic substances will be encouraged."

In addition to Basin Plan objectives, the CTR also establishes applicable numeric water quality criteria. These criteria are discussed in full in the Numeric Targets section of the TMDL.